SMART MAGNETIC BULK POLYMER NANOCOMPOSITES: FROM ELABORATION TO INVESTIGATION OF MULTISCALE MECHANICAL PROPERTIES UNDER APPLIED MAGNETIC FIELD

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We have elaborated smart bulk biopolymer composites derived from an organic matrix with surface modified magnetic nanoparticles and developed an extensive methodology for an experimental study of their mechanical and structural properties at different scales. Our strategy is based on the combination of the magnetic properties of superparamagnetic nanoparticles synthesized by polyol process and then functionalized by bi-functional ligands and the viscoelastic properties of biopolymer matrix. The multiscale thermo-mechanical properties of these new smart composites have been investigated by magneto-opto-rheology and photo acoustics techniques (Brillouin spectroscopy). Enhancement of viscosity at low shear rate and viscoelastic moduli in the linear viscoelastic domain has been clearly evidenced. These magnetic field modulated properties have been explained by the formation of microstructures due to electrostatic interactions between functionalized nanoparticles and biopolymer chains.

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